

## SYSTEM AND METHOD FOR ENHANCED PRINTING CAPABILITIES USING A PRINT JOB MANAGER FUNCTION

### FIELD OF THE INVENTION

5       The present invention is directed generally to a method for printing documents and specifically to an improved method for distributing a document to a plurality of printers based on the document's printing requirements.

### BACKGROUND OF THE INVENTION

10      The need to perform basic administrative duties as quickly as possible drives the need for tools that improve office productivity. In many offices, one major bottleneck that workers face is the printer. When printer resources are limited, the ability to maximize printer productivity is critical to improving efficiency. However, as the quality of documents increases with more specialized fonts, enhanced color graphics, and new document macros, the print jobs in the print  
15     queues are becoming larger causing the print queues to become longer. Moreover, as documents become more specialized, the ability of a single printer to handle the entire document decreases. Therefore, a need exists for a method for printing a single print job correctly and efficiently.

      The prior art method of printing a complex print job is to send the entire document to a single printer. If the printer already has a print queue with numerous print jobs, the print time for  
20     the last queued document can be extensive. This problem is further compounded when one or more of the pages of the document contain color based graphics in encapsulated post-script format, complex macros, sophisticated fonts, and/or embedded graphics. These specialized document images may not be printed properly if the printer receiving the job does not have the required capabilities. For example, if a document containing pages with color text or images is

queued to a black and white printer, then the desired effect of the colors in the document is lost. Additionally, the text may not be processed properly if a specific printer is not postscript and/or graphic capable. In another example, documents containing digital photographs may not be acceptable if the photographic images are not printed on photographic paper. Therefore, a need 5 exists for a method of printing a complex document on a plurality of normal and specialty printers.

The prior art has addressed the problem of print manager control of multiple printers. For example, United States Patent 5,327,526 (the ‘526 patent) entitled “Print Job Control System” discloses a method of printing a plurality of documents in which the documents are printed 10 according to a predefined priority indicator. The method disclosed in the ‘526 patent continuously manipulates the order of the print jobs to insure that the highest priority jobs are printed before the lower priority jobs. However, the ‘526 patent does not disclose a method of dividing print jobs based on the characteristics of the print jobs. The ‘526 patent also does not disclose a method for dividing a print job among a plurality of printers. Therefore, a need exists 15 for a method of separating a print job and sending the document to a plurality of printers.

United States Patent 5,547,178 (the ‘178 patent) entitled “Printer Mailbox Split Jobs Overflow Banner Sheet Indicator System” discloses a job splitting program. The method of the ‘178 patent breaks the print job into multiple print jobs when the print jobs exceeds the maximum capacity of the sorting bin in the copier. However, the ‘178 patent is limited to 20 separating print jobs based on *external* characteristics (the copier bin capacity). The ‘178 patent does not disclose a method of separating print jobs based on the *internal* document characteristic, that is the characteristics of the document to be printed. The ‘178 patent also does not disclose a method for dividing a print job among a plurality of printers. Therefore, a need exists for a

method of separating a print job based on document characteristics and sending the document to a plurality of printers.

United States Patent 5,859,711 (the ‘711 patent) entitled “Multiple Print Engine with Virtual Job Routing” discloses a method for distributing a print job to multiple printers. The 5 method disclosed in the ‘711 patent sends the print jobs to multiple print engines then reassembles the document. However, the ‘711 patent does not disclose an orderly method for separating the document and selecting the printers based on the time required to print each print job. Therefore, a need exists in the art for a method of separating a print job based on the printing needs of the document and sending the document to a plurality of printers based on the 10 time to print a section of the document at each of the plurality of printers.

Consequently, a need exists in the art for a method and apparatus for analyzing a document and separating the document based on the internal document characteristics. Furthermore, a need exists in the art for a method of sending the separated document to a plurality of printers. Finally, a need exists in the art for a method of determining the most 15 efficient routing method for a document based on the print queue of a plurality of printers and the specific document characteristics.

## SUMMARY OF THE INVENTION

The present invention, which meets the needs stated above, is a methodology for 20 separating a document, sending the document pages to a plurality of different printers based on the document page characteristics, and reassembling the document. The software embodiment of the present invention comprises a Classification Program (CP), a Specific Printer Program (SPP), a Color Printer Program (CPP), and a Black/White Printer Program (B/WPP). The CP analyzes

the metadata in each page of the document to determine if the page should be sent to a specific printer, a color printer, or a black/white printer. The CP separates the document, places each page in a holding queue for the appropriate printer, and runs the SPP, CPP, and B/WPP. The SPP compiles the pages from the specific printer holding queue to form a print job, compares the print job to a specific printer page threshold, and separates the print job into a plurality of print jobs if necessary. The SPP also analyzes the available specific printers to determine the specific printer with the shortest wait time and sends the print job to the appropriate printer. The CPP compiles the pages from the color printer holding queue to form a print job, compares the print job to a color printer page threshold, and separates the print job into a plurality of print jobs if necessary. The CPP also analyzes the available color printers to determine the color printer with the shortest wait time and sends the print job to the appropriate printer. The B/WPP compiles the pages from the black/white printer holding queue to form a print job, compares the print job to a black/white printer page threshold, and separates the print job into a plurality of print jobs if necessary. The B/WPP also analyzes the available black/white printers to determine the black/white printer with the shortest wait time and sends the print job to the appropriate printer.

10 The document may then be reassembled from the various printers to produce a finished document which was printed in considerably less time than the prior art printing methods.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is an illustration of a computer network used to implement the present invention;

FIG. 2 is an illustration of a computer memory and processor associated with the present invention;

FIG. 3 is an illustration of the Classification Program (CP) of the present invention;

5 FIG. 4 is an illustration of the Specific Printer Program (SPP) of the present invention;

FIG. 5 is an illustration of the Color Printer Program (CPP) of the present invention;

FIG. 6 is an illustration of the Black/White Printer Program (B/WPP) of the present invention; and

FIG. 7 is an illustration of the process of printing a document utilizing the present

10 invention.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

As used herein, the term “computer” shall mean a machine having a processor, a memory, and an operating system, capable of interaction with a user or other computer, and shall include without limitation desktop computers, notebook computers, personal digital assistants (PDAs), servers, handheld computers, and similar devices.

As used herein, the term “document” means a computer file comprising two or more pages which a user wants to print.

As used herein, the term “metadata” means hidden data in a document describing printable document data. For example, a file header embedded within a document that states that a document contains color graphics, color effects, macros, a specific font, or other specific requirements is metadata. Persons skilled in the art are aware of other types of metadata.

As used herein, the term “print farm profile” means data for at least one printer including the number, size, type, and other properties of print jobs in the print queue for the printer, the printer speed, amount of paper in the printer bin, and other properties concerning the printer.

As used herein, the term “print job” means a document which has been allocated to a printer for printing. The separated pages of a document are sent to a holding queue until the document is fully separated, at which point the pages in the holding queue are compiled into a single print job. A print job may be further separated into two or more print jobs if the print job exceeds a printer page threshold.

As used herein, the term “separate” means to divide the pages of a document or print job into two or more print jobs. Documents are only separated at the page boundaries; individual document pages cannot be separated.

FIG. 1 is an illustration of computer network **80** associated with the present invention. Computer network **80** comprises local machine **85** electrically coupled to network **86**. Local machine **85** is electrically coupled to remote machine **84** and remote machine **83** via network **86**. Local machine **85** is also electrically coupled to server **81** and database **82** via network **86**. Network **86** may be a simplified network connection such as a local area network (LAN) or may be a larger network such as a wide area network (WAN) or the Internet. Furthermore, computer network **80** depicted in FIG. 1 is intended as a representation of a possible operating network that may contain the present invention and is not meant as an architectural limitation.

The internal configuration of a computer, including connection and orientation of the processor, memory, and input/output devices, is well known in the art. The present invention is a methodology that can be embodied in a computer program. Referring to FIG. 2, the methodology of the present invention is implemented on software by Classification Program

(CP) **200**. CP **200** includes Specific Printer Program (SPP) **300**, Color Printer Program (CPP) **400**, and Black/White Printer Program (B/WPP) **500**. CP **200**, SPP **300**, CPP **400**, and B/WPP **500** described herein can be stored within the memory of any computer depicted in FIG. 1. Alternatively, CP **200**, SPP **300**, CPP **400**, and B/WPP **500** can be stored in an external storage device such as a removable disk, a CD-ROM, or a USB storage device. Memory **100** is illustrative of the memory within one of the computers of FIG. 1. Memory **100** also contains print farm profile **102**. The present invention may interface with print farm profile **102** through memory **100**. As part of the present invention, the memory **100** can be configured with CP **200**, SPP **300**, CPP **400**, and/or B/WPP **500**. Processor **106** can execute the instructions contained in CP **200**, SPP **300**, CPP **400**, and/or B/WPP **500**.

In alternative embodiments, CP **200**, SPP **300**, CPP **400**, and/or B/WPP **500** can be stored in the memory of other computers. Storing CP **200**, SPP **300**, CPP **400**, and/or B/WPP **500** in the memory of other computers allows the processor workload to be distributed across a plurality of processors instead of a single processor. Further configurations of CP **200**, SPP **300**, CPP **400**, and/or B/WPP **500** across various memories are known by persons of ordinary skill in the art.

Turning to FIG. 3, the logic of Classification Program (CP) **200** is illustrated. CP **200** is a methodology for separating a document into the pages that contain color graphics, black and white text, or other features suitable for a specific printer. The separation of the document that occurs in CP **200** may optionally be combined with the separation of print jobs that is described in SPP **300**, CPP **400**, and B/WPP **500**. CP **200** starts (202) when a user desires to print a document. CP **200** receives the document to be printed (204). CP **200** sends an acknowledgement back to the computer that originated the document (206). CP **200** then

analyzes the first page of the document (208). In analyzing the first page of the document, CP 200 examines the metadata for the first page of the document to determine if the first page of the document contains any color graphics or effects. CP 200 also analyzes the document metadata to determine if the first page contains any fonts, digital photographs, graphics, or other effects that require a specific printer to print the page. Examples of specific printers are printers containing letterhead, photographic printers, and any other printer which is enabled to print fonts or images unprintable by other printers. The document metadata may include any of the following data about the document: document size, document type, text type, text color, graphic type, graphic color, priority of print job, page size, page format characteristics, and/or document resolution requirements. Alternatively, the document metadata may specifically direct a page to a specific printer without indicating the reasons why the page is to be printed on a specific printer. An example of a specific printer direction is directing one or more pages of the document to the closest printer to the user's computer or a printer at a specific location.

CP 200 then makes a determination whether the metadata for the current page specifies a specific printer (210). If the metadata specifies a specific printer for the current page, then CP 200 places the current page in a holding queue for the specific printer (212) and proceeds to step 220. There may possibly be a plurality of specific printer holding queues as some pages may require one type of specific printer while other pages require a different type of specific printer. The holding queue for the specific printer may be in any memory defined by a person of ordinary skill in the art such as cache memory. If at step 210 the metadata for the current page does not specify a specific printer, then CP 200 proceeds to step 214.

At step 214, CP 200 then makes a determination whether the metadata for the current page indicates that there are color effects, graphics, or any other need for a color printer in the

current page (214). If the metadata indicates the need for a color printer for the current page, then CP 200 places the current page in a holding queue for the color printer (216) and proceeds to step 220. The holding queue for the color printer may be in any memory defined by a person of ordinary skill in the art such as cache memory. If at step 214 the metadata for the current page 5 does not indicate the need for a color printer, then CP 200 places the page in a holding queue for a black and white printer (218), and proceeds to step 220. The holding queue for the black/white printer may be in any memory defined by a person of ordinary skill in the art such as cache memory.

At step 220 CP 200 determines if there any pages remaining (220). If there are pages 10 remaining, then CP 200 analyzes the next page in the document (222) similar to the analysis in step 208. CP 200 then returns to step 210. Returning to step 220, if CP 200 determines that there are not any pages remaining, then CP 200 runs SPP 300 (224), runs CPP 400 (226), runs B/WPP 500 (228), and ends (230).

Turning to FIG. 4, the logic of Specific Printer Program (SPP) 300 is illustrated. SPP 15 300 is a methodology for printing the document pages that are stored in the specific printer holding queue. A document may request a specific printer if the document contains special sophisticated fonts, embedded graphics, or requires very high resolution. Specific printers may also contain a specific paper such as photographic quality (glossy) paper, perforated pages, or company letterhead. Specific printers may also be designated by the user, such as the printer in 20 room 2036. SPP 300 starts (302) when requested by CP 200. SPP 300 then accepts a user definition of a specific printer page threshold (304). The specific printer page threshold is the maximum number of pages to be printed as a single print job on any one printer. If the print job exceeds the specific printer page threshold, then the print job will be separated into a plurality of

smaller print jobs. The specific printer page threshold can be stored in memory so that the user does not have to enter a new specific printer page threshold upon every use of the present invention. Alternatively to accepting a user defined specific printer page threshold, SPP 300 can automatically select a specific printer page threshold by a method determined by persons of ordinary skill in the art.

Next, SPP 300 acquires the number of pages from the holding queue for the specific printer (306). SPP 300 compiles these pages into a single print job for the specific printer. If there is a plurality of specific printer holding queues, then SPP 300 creates a print job for each holding queue and repeats the method described herein for each type of specific printer required.

SPP 300 then makes a determination whether the number of pages in the current print job is greater than the specific printer page threshold (308). If the number of pages in the current print job is greater than the specific printer page threshold, then SPP 300 separates the print job (310) and returns to step 308. In separating the print job, SPP 300 may divide the print job into two even-sized print jobs. Alternatively, SPP 300 may extract a series of print jobs each less than the specific printer page threshold from the original print job until there are no print jobs exceeding the specific printer page threshold. Persons of ordinary skill in the art are aware of other methods for separating a print job. If at step 308 SPP 300 determines that the number of pages is not greater than the specific printer page threshold, then SPP 300 proceeds to step 312.

At step 312, SPP 300 determines the appropriate printer for the print job(s) (312). In order to determine the appropriate printer, SPP 300 analyzes the print farm profile 314 obtained from memory. Print farm profile 314 may be the print farm profile for only the specific printers or may be a print farm profile for all printers such as print farm profile 102 in FIG. 2. It is likely that there may be a plurality of specific printers and that SPP 300 will have to choose the most

appropriate printer(s) for the print job(s) from the available printers. **SPP 300** determines the appropriate printer by analyzing the number and size of print jobs queued for each specific printer. **SPP 300** calculates the print time for each document in the print queue by dividing the size of each print job by the printer speed. For example, if a forty page document is printing on a  
5 twenty page per minute (ppm) printer, the document will require two minutes of printer time. The total time until the printer is available may then be calculated by summing the print times for each document in the printer queue. **SPP 300** performs this calculation for every specific printer and designates the specific printer with the shortest wait time as the appropriate printer.

The printer with the shortest wait time may not necessarily be the printer with the fewest  
10 print jobs in the printer queue and **SPP 300** will select a printer with more items in a wait queue and a shorter wait time over a printer with fewer items in the wait queue and a longer wait time. For example, if a first printer is capable of printing at twenty ppm and has two separate forty-page documents in the wait queue, then the first printer will be available in four minutes. By contrast, if a second printer is capable of printing at ten ppm and has five separate two-page  
15 documents, then the second printer will be available in one minute. In the preceding example, the second printer is preferable over the first printer because the second printer has a shorter wait time. In an alternative embodiment, **SPP 300** can factor the time required to print the current print job into the calculation, which would then produce the time required to print the current print job as opposed to the time until the printer is available. If all of the printers have the same  
20 printing speeds, then the assignment of print jobs to printers will not change by calculating the time required to print the current print job. However, if the printers have different print speeds, then the assignment of print jobs to the printers may change by calculating the time required to print the current print job. Recalling the two printer example above, if the current print job is

one hundred pages, then the current print job may be printed in nine minutes (four minutes waiting and five minutes printing) on the first printer. By contrast, the same one hundred page document would take eleven minutes to print (one minute waiting plus ten minutes printing) on the second printer, making the first printer the appropriate printer. In a second example, if the 5 current document is only ten pages, then the document will take four and a half minutes to print on the first printer and two minutes to print on the second printer, making the second printer the appropriate printer.

SPP 300 may also determine the appropriate printers for a plurality of print jobs as is the case when the print job is separated into a plurality of print jobs. In this case, SPP 300 10 designates the printers with the shortest wait times as the appropriate printers. Alternatively, SPP 300 can designate the printers with the shortest print time as the appropriate printers. SPP 300 may also rank the printers based on the wait time for each printer or print time for each print 15 job and assign the largest print job to the printer that will be available first or print the fastest, and continue this processes until all the print jobs have been assigned to the printers. SPP 300 then sends the print job(s) to the appropriate printer(s) 318 (316). If the printed document pages 20 are to be reassembled manually, then SPP 300 will print a control page before the print job on each specific printer. The control page informs the user of the location of the printers that printed the separated parts of the original document. The user can use the control page(s) as instructions for reassembling the document. If the printed document pages are to be assembled by an automated process, then the control pages may not be necessary. SPP 300 then ends (320).

Turning to FIG. 5, the logic of Color Printer Program (CPP) 400 is illustrated. CPP 400 is a methodology for printing the document pages that are stored in the color printer holding queue. CPP 400 starts (402) when requested by CP 200. CPP 400 then accepts a user definition

of a color printer page threshold (**404**). The color printer page threshold is the maximum number of pages to be printed as a single print job on any one printer. If the print job exceeds the color printer page threshold, then the print job will be separated into a plurality of smaller print jobs.

The color printer page threshold can be stored in memory so that the user does not have to enter

- 5 a new color printer page threshold upon every use of the present invention. Alternatively to accepting a user defined color printer page threshold, CPP **400** can automatically select a color printer page threshold by a method determined by persons of ordinary skill in the art.

Next, CPP **400** acquires the number of pages from the holding queue for the color printer

(**406**). CPP **400** compiles these pages into a single print job for the color printer. CPP **400** then

- 10 makes a determination whether the number of pages in the current print job is greater than the color printer page threshold (**408**). If the number of pages in the current print job is greater than the color printer page threshold, then CPP **400** separates the print job (**410**) and returns to step **408**. In separating the print job, CPP **400** may divide the print job into two even-sized print jobs.

Alternatively, CPP **400** may extract a series of print jobs each less than the color printer page

- 15 threshold from the original print job until there are no print jobs exceeding the color printer page threshold. Persons of ordinary skill in the art are aware of other methods for separating a print job. If at step **408** CPP **400** determines that the number of pages is not greater than the color printer page threshold, then CPP **400** proceeds to step **412**.

At step **412**, CPP **400** determines the appropriate printer for the print job(s) (**412**). In

- 20 order to determine the appropriate printer, CPP **400** analyzes the color print farm profile **414** obtained from memory. Print farm profile **414** may be the print farm profile for only the color printers or may be a print farm profile for all printers such as print farm profile **102** in FIG. 2. It is likely that there may be a plurality of color printers and that CPP **400** will have to choose the

most appropriate printer(s) for the print job(s) from the available printers. CPP **400** determines the appropriate printer by analyzing the number and size of print jobs queued for each color printer. CPP **400** calculates the print time for each document in the print queue by dividing the size of each print job by the printer speed. For example, if a forty page document is printing on a twenty page per minute (ppm) printer, the document will require two minutes of printer time.

5 The total time until the printer is available may then be calculated by summing the print times for each document in the printer queue. CPP **400** performs this calculation for every color printer and designates the color printer with the shortest wait time as the appropriate printer.

The printer with the shortest wait time may not necessarily be the printer with the fewest print jobs in the printer queue and CPP **400** will select a printer with more items in a wait queue and a shorter wait time over a printer with fewer items in the wait queue and a longer wait time.

10 For example, if a first printer is capable of printing at twenty ppm and has two separate forty-page documents in the wait queue, then the first printer will be available in four minutes. By contrast, if a second printer is capable of printing at ten ppm and has five separate two-page documents, then the second printer will be available in one minute. In the preceding example,

15 the second printer is preferable over the first printer because the second printer has a shorter wait time. In an alternative embodiment, CPP **400** can factor the time required to print the current print job into the calculation, which would then produce the time required to print the current print job as opposed to the time until the printer is available. If all of the printers have the same

20 printing speeds, then the assignment of print jobs to printers will not change by calculating the time required to print the current print job. However, if the printers have different print speeds, then the assignment of print jobs to the printers may change by calculating the time required to print the current print job. Recalling the two printer example above, if the current print job is

one hundred pages, then the current print job may be printed in nine minutes (four minutes waiting and five minutes printing) on the first printer. By contrast, the same one hundred page document would take eleven minutes to print (one minute waiting plus ten minutes printing) on the second printer, making the first printer the appropriate printer. In a second example, if the  
5 current document is only ten pages, then the document will take four and a half minutes to print on the first printer and two minutes to print on the second printer, making the second printer the appropriate printer.

CPP **400** may also determine the appropriate printers for a plurality of print jobs as is the case when the print job is separated into a plurality of print jobs. In this case, CPP **400**  
10 designates the printers with the shortest wait times as the appropriate printers. Alternatively, CPP **400** can designate the printers with the shortest print time as the appropriate printers. CPP **400** may also rank the printers based on the wait time for each printer or print time for each print job and assign the largest print job to the printer that will be available first or print the fastest, and continue this processes until all the print jobs have been assigned to the printers. CPP **400**  
15 then sends the print job(s) to the appropriate printer(s) **418 (416)**. If the printed document pages are to be reassembled manually, then CPP **400** will print a control page before the print job on each color printer. The control page informs the user of the location of the printers that printed the separated parts of the original document. The user can use the control page(s) as instructions for reassembling the document. If the printed document pages are to be assembled by an  
20 automated process, then the control pages may not be necessary. CPP **400** then ends (**420**).

Turning to FIG. 6, the logic of Black/White Printer Program (B/WPP) **500** is illustrated. B/WPP **500** is a methodology for printing the document pages that are stored in the black/white printer holding queue. B/WPP **500** starts (**502**) when requested by CP **200**. B/WPP **500** then

accepts a user definition of a black/white printer page threshold (504). The black/white printer page threshold is the maximum number of pages to be printed as a single print job on any one printer. If the print job exceeds the black/white printer page threshold, then the print job will be separated into a plurality of smaller print jobs. The black/white printer page threshold can be  
5 stored in memory so that the user does not have to enter a new black/white printer page threshold upon every use of the present invention. Alternatively to accepting a user defined black/white printer page threshold, B/WPP 500 can automatically select a black/white printer page threshold by a method determined by persons of ordinary skill in the art.

Next, B/WPP 500 acquires the number of pages from the holding queue for the  
10 black/white printer (506). B/WPP 500 compiles these pages into a single print job for the black/white printer. B/WPP 500 then makes a determination whether the number of pages in the current print job is greater than the black/white printer page threshold (508). If the number of pages in the current print job is greater than the black/white printer page threshold, then B/WPP 500 separates the print job (510) and returns to step 508. In separating the print job, B/WPP 500  
15 may divide the print job into two even-sized print jobs. Alternatively, B/WPP 500 may extract a series of print jobs each less than the black/white printer page threshold from the original print job until there are no print jobs exceeding the black/white printer page threshold. Persons of ordinary skill in the art are aware of other methods for separating a print job. If at step 508  
20 B/WPP 500 determines that the number of pages is not greater than the black/white printer page threshold, then B/WPP 500 proceeds to step 512.

At step 512, B/WPP 500 determines the appropriate printer for the print job(s) (512). In order to determine the appropriate printer, B/WPP 500 analyzes the black/white print farm profile 514 obtained from memory. Print farm profile 514 may be the print farm profile for only

the black/white printers or may be a print farm profile for all printers such as print farm profile **102** in FIG. 2. It is likely that there may be a plurality of black/white printers and that B/WPP **500** will have to choose the most appropriate printer(s) for the print job(s) from the available printers. B/WPP **500** determines the appropriate printer by analyzing the number and size of  
5 print jobs queued for each black/white printer. B/WPP **500** calculates the print time for each document in the print queue by dividing the size of each print job by the printer speed. For example, if a forty page document is printing on a twenty page per minute (ppm) printer, the document will require two minutes of printer time. The total time until the printer is available may then be calculated by summing the print times for each document in the printer queue.  
10 B/WPP **500** performs this calculation for every black/white printer and designates the black/white printer with the shortest wait time as the appropriate printer.

The printer with the shortest wait time may not necessarily be the printer with the fewest print jobs in the printer queue and B/WPP **500** will select a printer with more items in a wait queue and a shorter wait time over a printer with fewer items in the wait queue and a longer wait  
15 time. For example, if a first printer is capable of printing at twenty ppm and has two separate forty-page documents in the wait queue, then the first printer will be available in four minutes. By contrast, if a second printer is capable of printing at ten ppm and has five separate two-page documents, then the second printer will be available in one minute. In the preceding example, the second printer is preferable over the first printer because the second printer has a shorter wait  
20 time. In an alternative embodiment, B/WPP **500** can factor the time required to print the current print job into the calculation, which would then produce the time required to print the current print job as opposed to the time until the printer is available. If all of the printers have the same printing speeds, then the assignment of print jobs to printers will not change by calculating the

time required to print the current print job. However, if the printers have different print speeds, then the assignment of print jobs to the printers may change by calculating the time required to print the current print job. Recalling the two printer example above, if the current print job is one hundred pages, then the current print job may be printed in nine minutes (four minutes 5 waiting and five minutes printing) on the first printer. By contrast, the same one hundred page document would take eleven minutes to print (one minute waiting plus ten minutes printing) on the second printer, making the first printer the appropriate printer. In a second example, if the current document is only ten pages, then the document will take four and a half minutes to print on the first printer and two minutes to print on the second printer, making the second printer the 10 appropriate printer.

B/WPP **500** may also determine the appropriate printers for a plurality of print jobs as is the case when the print job is separated into a plurality of print jobs. In this case, B/WPP **500** designates the printers with the shortest wait times as the appropriate printers. Alternatively, B/WPP **500** can designate the printers with the shortest print time as the appropriate printers. 15 B/WPP **500** may also rank the printers based on the wait time for each printer or print time for each print job and assign the largest print job to the printer that will be available first or print the fastest, and continue this processes until all the print jobs have been assigned to the printers. B/WPP **500** then sends the print job(s) to the appropriate printer(s) **518 (516)**. If the printed document pages are to be reassembled manually, then B/WPP **500** will print a control page 20 before the print job on each black/white printer. The control page informs the user of the location of the printers that printed the separated parts of the original document. The user can use the control page(s) as instructions for reassembling the document. If the printed document

pages are to be assembled by an automated process, then the control pages may not be necessary. B/WPP 500 then ends (520).

Turning to FIG. 7, the process of printing a document utilizing the present invention is illustrated. A user has indicated a desire to print document 702 by clicking the print button or some similar action. As indicated in box 704, the pages of document 702 require a printer with company letterhead, a color printer, a photo-quality printer, and a black/white printer. The document is sent to the print manger of the present invention 706 which may contain CP 200, SPP 300, CPP 400, and/or B/WPP 500. The print manager separates the documents into components that require a printer containing company letterhead 708, color printers 710 and 712, photo printer 714, and black/white printers 716, 718, 720, and 722. The print manager may decide to send pages 17-19 of the document to color printer 712 instead of color printer 710 due to a long wait time on color printer 710. The print manager may also decide to separate pages 20-78 of the document and send pages 20-50 to black/white printer 718 and pages 51-78 to black/white printer 720. When the pages have printed on the various printers, then the document isreassembled in a reassembly process 724 to produce a finished document 726.

With respect to the above description, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one of ordinary skill in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention. The novel spirit of the present invention is still embodied by reordering or deleting some of the steps contained in this disclosure. The spirit of the invention is not meant to be limited in any way except by proper construction of the following claims.